

WHAT IS CLAIMED IS:

1. A method of fabricating an interconnect supported by a semiconductor structure, comprising the steps of:
 - forming a first layer of titanium nitride on the semiconductor structure;
 - forming a second layer of titanium nitride on the first layer of titanium nitride; and
 - forming an aluminum film on the second layer of titanium nitride.
2. The method of claim 1, further comprising the step of forming a titanium silicide layer on the semiconductor structure prior to the step of forming the first layer of titanium nitride.
3. The method of claim 1, wherein the step of forming the first layer of titanium nitride comprises the following steps:
 - flowing a titanium-containing precursor in a chemical vapor deposition reaction chamber; and
 - flowing nitrogen in the chemical vapor deposition chamber simultaneously with the step of flowing the titanium-containing precursor.
4. The method of claim 3, wherein the titanium-containing precursor is selected from the group consisting of: titanium tetrachloride, tetrakisdimethylamido titanium, and trimethylethylenediamino titanium.
5. The method of claim 1, wherein the step of forming the second layer of titanium nitride comprises the following steps:
 - flowing a titanium-containing precursor in a chemical vapor deposition reaction chamber; and

flowing a gas selected from the group consisting of ammonia and nitrogen trifluoride in the chemical vapor deposition reaction chamber simultaneously with the step of flowing the titanium-containing precursor.

6. The method of claim 5, further comprising the step of flowing nitrogen in the chemical vapor deposition reaction chamber simultaneously with the step of flowing the titanium-containing precursor.
7. The method of claim 5, wherein the titanium-containing precursor is selected from the group consisting of: titanium tetrachloride, tetrakisdimethylamido titanium, and trimethylethylenediamino titanium.
8. The method of claim 1, wherein the step of forming the aluminum film comprises the step of flowing an aluminum-containing precursor in a chemical vapor deposition chamber.
9. The method of claim 8, wherein the aluminum-containing precursor is selected from the group consisting of: trimethylaluminum (TMA), dimethylaluminum hydride (DMAH), triisobutylaluminum (TIBA), triethylaluminum (TEA), diethylaluminum hydride (DEAH), monomethylaluminum hydride (MMAH), dimethylethylalane (DMEHA1), and dimethylethylamide (DMEHA2).
10. A method of forming an aluminum film on a semiconductor structure in a chemical vapor deposition reaction chamber, comprising the steps of:
 - flowing an aluminum-containing precursor in the chemical vapor deposition reaction chamber; and
 - flowing at least one gas selected from the group consisting of ammonia and nitrogen trifluoride in the chemical vapor deposition reaction chamber to form the aluminum film.

11. The method of claim 10, wherein the aluminum-containing precursor is selected from the group consisting of: trimethylaluminum (TMA), dimethylaluminum hydride (DMAH), triisobutylaluminum (TIBA), triethylaluminum (TEA), diethylaluminum hydride (DEAH), monomethylaluminum hydride (MMAH), dimethylethylalane (DMEHA1), and dimethylethylamide (DMEHA2).
12. The method of claim 10, wherein the aluminum film has a grain size of approximately less than 0.25 microns.
13. A method of fabricating an interconnect supported by a semiconductor structure in a chemical vapor deposition reaction chamber, comprising the steps of:
 - flowing a first titanium-containing precursor in the chemical vapor deposition reaction chamber;
 - flowing nitrogen in the chemical vapor deposition reaction chamber simultaneously with the step of flowing the titanium-containing precursor to form a first layer of titanium nitride on the semiconductor structure;
 - flowing a second titanium-containing precursor in the chemical vapor deposition reaction chamber;
 - flowing at least one gas selected from the group consisting of ammonia and nitrogen trifluoride in the chemical vapor deposition reaction chamber simultaneously with the step of flowing the second titanium-containing precursor to form a second layer of titanium nitride on the first layer of titanium nitride; and
 - flowing an aluminum-containing precursor in the chemical vapor deposition reaction chamber to form an aluminum film on the second layer of titanium nitride.

14. The method of claim 13, further comprising the step of forming a titanium silicide layer on the semiconductor structure prior to the step of flowing the first titanium-containing precursor.
15. The method of claim 13, wherein the first and second titanium-containing precursors are selected from the group consisting of: titanium tetrachloride, tetrakisdimethylamido titanium and trimethylethylenediamino titanium.
16. The method of claim 13, wherein the aluminum-containing precursor is selected from the group consisting of: trimethylaluminum (TMA), dimethylaluminum hydride (DMAH), triisobutylaluminum (TIBA), triethylaluminum (TEA), diethylaluminum hydride (DEAH), monomethylaluminum hydride (MMAH), dimethylethylalane (DMEHA1), and dimethylethylamide (DMEHA2).
17. An interconnect structure in an integrated circuit, comprising:
 - a first layer of titanium nitride;
 - an aluminum film;
 - a second layer of titanium nitride between the first layer of titanium nitride and the aluminum film.
18. The interconnect structure of claim 17, wherein the interconnect structure is supported by a source/drain region of a metal-oxide-semiconductor transistor.
19. The interconnect structure of claim 18, further comprising a layer of titanium silicide between the source/drain region and the first layer of titanium nitride.
20. The interconnect structure of claim 17, wherein the first and second layers of titanium nitride each have a thickness of approximately 100 to 200 angstroms.

21. The interconnect structure of claim 17, wherein the first layer of titanium nitride is amorphous.
22. The interconnect structure of claim 17, wherein the second layer of titanium nitride is crystalline.
23. The interconnect structure of claim 17, wherein the second layer of titanium nitride has a mixed crystal orientation, such that a crystal orientation of an aluminum grain is selected from the group consisting of: <111> and <200>.
24. The interconnect structure of claim 17, wherein the aluminum film has a thickness of approximately 2,000 to 3,000 angstroms.
25. The interconnect structure of claim 17, wherein the aluminum film has a polycrystalline grain structure.
26. The interconnect structure of claim 17, wherein the aluminum film has a grain size of less than approximately 0.25 microns.
27. An aluminum film supported by a semiconductor substrate, wherein the aluminum film has a grain size of approximately less than 0.25 microns in diameter.
28. An aluminum film supported by a semiconductor substrate, wherein the aluminum film has a grain size of approximately less than 0.25 microns and a polycrystalline grain structure.
29. An interconnect structure in an interconnect via defined by a bottom surface, a top surface, and sidewalls, comprising:

- a first layer of titanium nitride formed on the sidewalls and the bottom surface defining the interconnect via;
- a second layer of titanium nitride supported by the first layer of titanium nitride; and
- an aluminum film supported by the second layer of titanium nitride and extending throughout the interconnect via such that it is coplanar with the top surface defining the interconnect via.
30. The interconnect structure of claim 29, further comprising a layer of titanium silicide between the bottom surface of the interconnect via and the first layer of titanium nitride.
31. The interconnect structure of claim 29, wherein the first and second layers of titanium nitride each have a thickness of approximately 100 to 200 angstroms.
32. The interconnect structure of claim 29, wherein the first layer of titanium nitride is amorphous.
33. The interconnect structure of claim 29, wherein the second layer of titanium nitride is crystalline.
34. The interconnect structure of claim 29, wherein the second layer of titanium nitride has a mixed crystal orientation, such that a crystal orientation of an aluminum grain is selected from the group consisting of: <111> and <200>.
35. The interconnect structure of claim 29, wherein the aluminum film has a polycrystalline grain structure.
36. The interconnect structure of claim 29, wherein the aluminum film has a grain size of less than approximately 0.25 microns.